

WHAT IS CLAIMED IS:

1. Freeze-drying apparatus for foodstuffs, medicaments, etc., which comprises: a main body part constructed with an upright cylindrical tube for freezing liquid material onto the inner wall surface of said tube, and a jacket provided on and around the outer periphery of said tube in a substantially concentric cylindrical shape to cause heat medium to circulate in the interior of said tube; a duct communicatively connected, on the upper end side of said tube of said main body part, with a vacuum exhaust system either directly or through a chamber; an opening-closing valve or a recovery chamber equipped with a valve on the bottom part thereof being disposed or connected on the lower end side of said tube; and an inlet port for feeding the liquid material into the inner cavity of said tube which is mounted, on the upper or lower part of said tube, by connection of a tube-passageway for feeding said liquid material to the downstream side of said tube-passageway.

2. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein said main body part of said freeze-drying apparatus which is constructed with said upright cylindrical tube and said jacket surrounding on and around the outer periphery of said tube in the substantially concentric outer cylindrical shape, both being assembled together, is mounted on said machine frame by juxtaposing said tube in multiple series; then, on the upper end side of the respective tubes of said main body part, which are arranged in juxtaposition, there are connected the ducts communicating to the vacuum exhaust system, either directly or through the chamber; while, on the

lower end side of said each tube, there is connected the recovery chamber provided with an opening-and-closing valve, or a recovery chamber equipped with a valve on the bottom part thereof; and, on the upper or lower part of said tube, an inlet port for feeding the liquid material into the inner cavity of said tube being mounted by connection of a tube-passageway for feeding said liquid material to the downstream side of said tube-passageway.

3. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein said main body part of said freeze-drying apparatus which is constructed with said upright cylindrical tube and said jacket surrounding on and around the outer periphery of said tube in the substantially concentric outer cylindrical shape, both being assembled together, is mounted on the machine frame by juxtaposing said tube in a plurality of juxtaposed series; then, the upper end side of said each tube of said each main body part is made to open to said ducts communicated with the vacuum exhaust system supported on said machine frame, or made to open to the chamber connected to said duct; and, to each of the lower end sides of said tubes, there is connected the opening-and-closing valve or the recovery chamber equipped with the valve on the bottom part of said tube; and an inlet port for feeding the liquid material into the inner cavity of said each tube, said inlet port being defined in said ducts or said chamber connected to said duct.

4. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein said jacket in the outer cylindrical shape to be provided on the outer periphery of said

tube is divided into a plurality of sections in the vertical direction; and, while controllably circulating said heat medium in said jacket at its controlled temperature to a desired level, said liquid material is caused to freeze on the inner wall surface of said tubes.

5. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein said main body part of said freeze-drying apparatus, constructed by assembling of said upright cylindrical tubes and the jackets surrounding the outer periphery of said each tube in the substantially concentric outer cylindrical shape, is juxtaposed in multiple series, and is mounted on said machine frame; and the upper end side of said each tube is communicatively connected to said ducts leading to said vacuum exhaust system through said freely opening-and-closing valve.

6. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein said main body part of said freeze-drying apparatus, constructed with said upright cylindrical tubes and the jackets surrounding the outer periphery of said each tube in the substantially concentric outer cylindrical shape, is juxtaposed in multiple series and mounted on said machine frame, said jacket to be provided on the outer periphery of said each tube being connected in parallel, through the freely opening-and-closing valve.

7. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein there is provided a funnel-shaped inclined wall, at a downwardly protruding portion from said jacket surrounding the lower end side of said upright cylindrical tube, with the diameter thereof being gradually reduced in the downward direction in such a manner that said

diameter-reduced portion at the lower end of said funnel-shaped inclined wall can be situated below the lower edge of the liquid material to be frozen in the cylindrical shape on the inner wall surface of said tube.

8. Freeze-drying apparatus for foodstuffs, medicaments, etc., according to Claim 1, wherein there is provided a supporting member, situated below the lower edge of the liquid material to be frozen onto the inner wall surface of said tube, projecting toward the inner cavity of said tube from the inside surface thereof, which is in the inside surface of a location protruding downward from the jacket surrounding said tube, at the lower end side of the upright cylindrical tube, said supporting member being mounted in such a manner as to be fixed at a position, or retractable with respect to said tube.